CORNELL Turfgrass

Cornell University Turfgrass Times
New York Greengrass Association
P.O. Box 612
Latham, NY 12110

Nonprofit Org.
U.S. POSTAGE
PAID
Permit No. 30
Latham, NY 12110

Healthy Ecosystem

As plots matured, there was a strong reduction in the volume of leachate and runoff seen leaving all plots.

A Turfgrass Environmental Stewardship Funded Project

Cosmetic Applications of Fertilizers and Pesticides to Turfgrass

There is growing scrutiny on the use of fertilizers and pesticides in the landscape and the impact they may have on water quality. For many, the use of fertilizers and pesticides in the landscape appear to serve no greater function than providing a "cosmetic" benefit that improves the aesthetic appearance of the lawn. This raises the question: do the "cosmetic" applications of nutrients and pesticides actually serve a greater function to the landscape ecosystem above the aesthetic improvement. It is known that fertilizer and pesticide applications help to improve both canopy and rooting density of lawns and turfgrass which actually can reduce the impact of off-site nutrient and pesticide loss by reducing the amount of runoff. Now, obviously you will not have pesticide loss if you do not apply pesticides, but can the non-use of pesticides lead to a lawn that is more susceptible to canopy thinning through pest pressure? If so, this may ultimately promote higher runoff and leaching losses of nutrients and sediments due to lower uptake rates, and surface interception ability.

We looked to answer these questions by comparing various lawn management protocols common in the landscape that consist of irrigation, pesticides, and fertilizers similar to a conventional four step consumer lawn program and compared those to lawns of various mixtures of weedy species and even Kentucky bluegrass lawns to determine if there was any benefit to the "cosmetic" application of fertilizers and pesticides on the reduction of nutrient loading to waterways through leachate and runoff.

After two and a half years of consecutive monitoring both runoff and leaching from eight different lawn types that represent an array of those that exist in New York State, there were several trends and underlying principles seen important to urban watershed management. First and foremost is the importance of managing newly established sites carefully and with limited inputs of nutrients and pesticides. This finding is directly supported by other peer reviewed research and is of great importance due to the compacted soil surfaces formed through heavy equipment and the lack of rooting from plants that reduces nutrient and water uptake. The establishment period of this study led to the highest levels seen of all pesticides

continued on page 10

CUTT

Healthy Ecosystem

continued from page 16

The use of irrigation after the application of fertilizers and pesticides reduced the concentrations of both nutrients and pesticides lost through runoff and leachate. This process helps to lightly wash chemicals and nutrients off of plant leaves and integrate them into the soil surface where they can bind to soil particles or enter soil solution, making them available for plant uptake or available for breakdown in the case of pesticides.

that were detected in runoff and often the highest levels of both nitrogen and phosphorus in runoff and leachate.

As plots matured, there was a strong reduction in the volume of leachate and runoff seen leaving all plots. This finding strongly correlated with lower concentrations of nutrients lost due to more vigorous plant growth and the apparent uptake of water and nutrients. The denser, more established canopies provided more mature plants that left smaller amounts of water available to leave the site and enter waterways. There was also a general trend of higher water loss in the winter and spring months when plants were either dormant or not fully growing due to cool temperatures that often led to saturated soil conditions.

There were differences on the plot scale of how management and species composition affected nutrient loss. The use of irrigation after the application of fertilizers and pesticides reduced the concentrations of both nutrients and pesticides lost through runoff and leachate. This process helps to lightly wash chemicals and nutrients off of plant leaves and integrate them into the soil surface where they can bind to soil particles or enter soil solution, making them available for plant uptake or available for breakdown in the case of pesticides. When not integrated, these products can be more susceptible to running off during intense rain storms that wash them off site following application.

Overall, plots that had the largest losses of runoff and leachate volume had the largest mass losses of nutrients. These losses were generally caused by decreased plant density of the plot either caused by the high composition of annual weedy species, or through poor fertility that led to thinning turfgrass cover. This ultimately, reduced the amount of water taken up from the soil by the plants which kept the soil moisture level higher. Increased soil moisture cause increase runoff due to saturation excess runoff, which means there is physically no way the precipitation can enter the soil profile because it has reached its maximum water holding capacity. Secondly, lack of lawn density decreases the waters resistant pathway that reduces flows down a slope, causing it to travel faster, allowing less time for the water to infiltrate into the soil. These two conditions led to the majority of runoff and leachate losses from the sites.

There were direct links to some nutrient loss that was tied to fertilizer applications. Ammonium in runoff was only seen in significant amounts from turfgrass plots that receive fertilizer containing some ammonium, but these values were low, and overall only accounted for less than 0.5% of total applied nitrogen for the course of the entire study. However, total ammonium losses for the entire study were as high or higher for plots consisting of weedy species that did not receive any supplemental fertilization compared to the turfgrass lawns. Nitrate loss in leachate contributed the largest overall source of nutrient loss from the landscape. Up to 20% of nitrogen applied was lost in leachate from the turfgrass plots that received fertilizer. However, substantial nitrate losses were seen from unfertilized

Table 1. Total nutrient loss in a 27 month period from leachate.

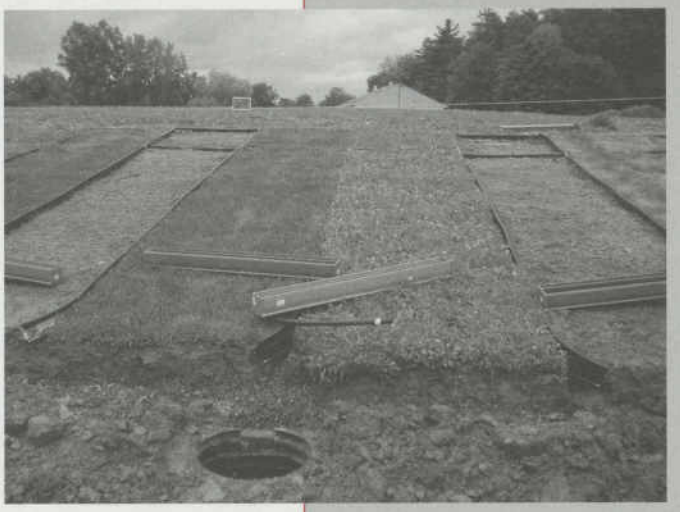
	Nutrient mass loss in leachate lbs acre-[1]					Total Leachate
Lawn Type*	NH4+	NO3-	Organic N	PO4-3	Total P	Inches
Turfgrass+F+P+I	0.79	49.69	1.48	0.15	0.15	15.92
Turfgrass+F+P	0.32	31.05	0.88	0.03	0.05	4.99
Turfgrass+F	0.45	56.18	2.38	0.24	0.25	9.94
Turfgrass	0.66	50.83	1.70	0.13	0.14	15.20
Broadleaf	0.47	5.79	1.16	0.07	0.08	9.69
Broadleaf+Turfgrass	1.21	37.53	1.53	0.11	0.14	14.92
Crabgrass	0.68	29.96	0.99	0.20	0.21	12.47
Crabgrass+Turfgrass	0.75	56.01	1.67	0.05	0.06	14.83

*With F=fertilizer, P=pesticide, I=irrigation

plots which provide evidence that not all nitrogen loss to waterways can be attributed to fertilizer alone, but natural processes in the landscape ecosystem can be a substantial source of nitrogen loss through leachate.

Landscape pesticides used in this study did not appear to be a major threat to waterways if used properly. During the establishment phase, losses of 2,4-D and mecoprop were the highest, but values dropped significantly as the plots aged. Both of these broadleaf herbicides appeared to be more mobile and found at significantly higher values than the insecticide (bifenthrin) and the pre-emergent herbicide (pendimethalin) used in this study. The use of supplemental irrigation to water in applications of pesticides appeared to minimize the potential loss of these pesticides to waterways as compared to not watering in.

It is our finding that turfgrass maintained for aesthetic purposes to maintain good density and color does not potentially impose adverse affects as a non-point source of pollution to waterways compared to other lawn cover types. The reduction or non-use of these products during establishment periods may be important because of the greatest loss into the environment due to low infiltration rates of the soil, and low uptake rates of the cover species. However, most new varieties of Kentucky bluegrass do not fare well with minimal or no supplemental fertilization, and care should be taken to provide adequate fertility to newly establishing sod so that it does not become thin and weed infested as observed here. If fertilizers and pesticides are applied properly at the rate given, they provide nutrients necessary to maintain a dense canopy that is not seen in unfertilized turfgrass plots. Unfertilized turfgrass plots became very thin and contained upwards of 30-40% weedy species after only a two year period following establishment through sod. This phenomenon allowed them to become one of the largest contributors to off-site nutrient loss over time of all the plots studied.



Not having large populations of annual weedy species in lawns such as crabgrass may be an important tool to combat sediment and runoff losses of nutrients due to inconsistent densities and cover types that lead to large volumes of runoff losses. From this study, it has become apparent that maintaining a dense perennial lawn cover at all times, regardless of species composition appears to be the most important component of combating non-point pollution of nutrients and pesticides to waterways from urban lawns. If allowed to become thin and sparse, there often is a large nutrient pool stored in the soil profile that becomes more available to off-site transport to sensitive waterways.

Table 2. Total nutrient loss in a 27 month period from runoff.

	Mass loss of nutrients in runoff lbs acre-[1]					Total Runoff
Lawn type	NH4+	NO3-	Total Nitrogen	PO4-3	Total Bioavailable Phosphorus	Inches
Turfgrass+F+P+I	3.13	1.05	5.47	0.30	0.56	3.83
Turfgrass+F+P	4.13	0.52	6.35	0.29	0.40	1.20
Turfgrass+F	2.17	0.23	2.81	0.11	0.25	0.93
Turfgrass	0.89	0.59	2.11	0.22	0.87	2.83
Broadleaf	0.47	0.41	1.34	0.08	0.11	1.56
Broadleaf+Turfgrass	0.71	0.52	1.77	0.14	0.36	1.94
Crabgrass	0.68	1.19	2.69	0.21	1.35	4.29
Crabgrass+Turfgrass	0.45	0.75	2.23	0.24	0.18	2.35

Mark Slavens and
A. Martin Petrovic, Ph.D.,
Cornell Univerity